

1. What is our independent variable? What is our dependent variable?

Independent variable is the word condition (congruent/incongruent) as the word condition is not changed by the congruency or incongruency. Dependent variable is the time taken to name ink colours.

2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

Alternative hypothesis is the hypothesis testing the claim that I make or it is the hypothesis covering the test condition. According to Stroop effect, time in congruent condition is greater than time in incongruent condition, which is the alternative hypothesis.

$$H_A: \mu_{\text{incongruent}} > \mu_{\text{congruent}}$$

The null hypothesis will be that the event had no effect i.e. there is no difference in time required for both congruent and incongruent condition.

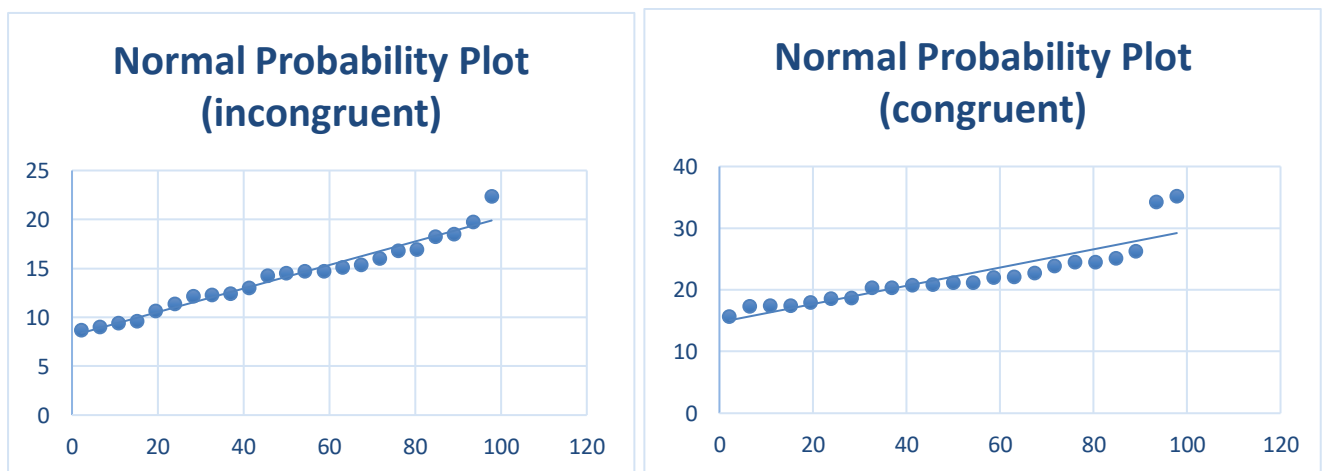
$$H_0: \mu_{\text{incongruent}} = \mu_{\text{congruent}}$$

$\mu_{\text{incongruent}}$ = population mean of incongruent values

$\mu_{\text{congruent}}$ = population mean of congruent values

(Population mean is referred to here as the entire set of the values are used, and not just a sample)

To determine the type of statistical test to be performed, we need to first determine the normality of the data supplied for both congruent and incongruent values. The data is roughly normally distributed.



A two-tailed dependent t-test because we are comparing two dependent samples of data.

Now, t-test is used for this test rather than a z-test because of the following reasons:

- t-test is more suitable for small sample size (here, $n=$, as t test suitable for [n<30](#))
- Population standard deviation is unknown and hence t-test is appropriate.

3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Congruent:

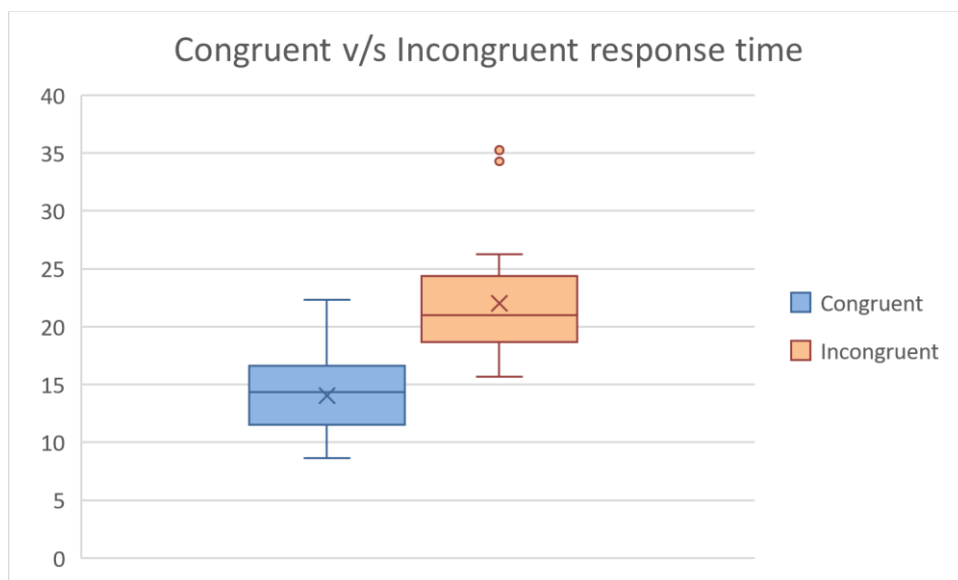
Mean: 14.05113 Std Deviation: 3.559358

Incongruent:

Mean: 22.01592 Std Deviation: 4.797057

4. Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

a) Response time in terms of boxplot



It is clearly observable that the response time for congruent condition is lower overall with much less median values than the incongruent condition.

5. Now, perform the statistical test and report your results. What is your confidence level and your critical statistic value? Do you reject the null hypothesis or fail to reject it? Come to a conclusion in terms of the experiment task. Did the results match up with your expectations?

t-Test: Paired Two Sample for Means

	<i>Congruent</i>	<i>Incongruent</i>
Mean	14.051125	22.01591667
Variance	12.66902907	23.01175704
Observations	24	24
Pearson Correlation	0.351819527	
Hypothesized Mean Difference	0	
df	23	
t Stat	-8.020706944	

P(T<=t) one-tail	2.0515E-08
t Critical one-tail	1.713871528
P(T<=t) two-tail	4.103E-08
t Critical two-tail	2.06865761

The dependent t-test of differences between Congruent ($M = 14.051125$) and Incongruent ($M = 22.01591667$) was conducted at $\alpha=0.05$. Here P value ie $P(T \leq t)$ two-tail < 0.05 . Hence, the difference in response time is significant and alternative hypothesis stands.
Hence, null hypothesis is rejected

6. Optional: What do you think is responsible for the effects observed? Can you think of an alternative or similar task that would result in a similar effect? Some research about the problem will be helpful for thinking about these two questions!

The brain associates the shape of the word with the colour so that the memory storage and retention is faster. When there is a mismatch, additional time is required to process the information and decide on its meaning.

A similar effect may be observed if the participants were shown words of the correct colour but the wrong spelling. However, in this case the difference would be less pronounced as the visual colour representation is likely to be more ingrained in the brain than word shape associations.